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atom must be two, or half its atomic weight—also in agreement with the Rutherford theory.

So far so good. But when we consider the hydrogen and helium spectra, we get into difficulty immediately. Stark, Fischer and Kirschbaum,⁶ from a recent careful study of the Stark-Doppler effect in connection with helium canal rays, conclude that the series of single lines which Runge and Paschen ascribe to "parhelium" are emitted by the doubly charged helium atom. Also, according to Stark's hypothesis (which, though not proved, yet seems probable from certain indirect evidence) the hydrogen series lines are emitted by the single charged hydrogen atom. Now, both the "parhelium" and the hydrogen series lines show the normal Zeeman effect and therefore can not be emitted by systems devoid of vibrating electrons. Stark's hypothesis therefore demands a more complex atom; it is incompatible with the Rutherford theory as far as hydrogen and helium are concerned.

Also, recent experiments seem to associate the compound spectrum of hydrogen with the positively charged molecule. It is of course enormously complex. Many of its lines show a normal Zeeman effect, others an abnormal effect, others apparently no effect at all.⁷ How such a spectrum can be due to the vibrations of a single electron around two positive nuclei seems inconceivable.

Certainly the Rutherford atom seems much too simple to explain these spectral phenomena, though perhaps these and other objections may be overcome. Is this conception of the atom the only one which leads to the expression for the distribution of scattered α rays which Geiger and Marsden have so thoroughly verified? If possible, the scattering effect of hydrogen should be tested. Perhaps this might be done by the use of a compound of hydrogen or liquid hydrogen. Such experiments on the scattering of α and β rays seem our most promising means of securing more exact knowledge of the actual structure of atoms; but the conceptions thus suggested must explain or be in accord with a wide variety of atomic phe-

nomena before they can expect general acceptance.

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NOTES ON ENTOMOLOGY

ECONOMIC entomologists will welcome the appearance of a new monthly journal—*The Review of Applied Entomology*. It is published in London (Dulau & Co.) and issued in two series: series *A*, agricultural; series *B*, medical and veterinary. It consists almost wholly of reviews of other works, or reports sent in by various investigators. The journal is supported by the Imperial Bureau of Entomology, and Guy A. K. Marshall is the editor, while a series of distinguished entomologists and naturalists form a committee of management. The parts so far issued average 32 pages for series *A*, and 20 pages for series *B*. In series *B* there are references to new species in certain groups of general medical importance, as mosquitoes and Tabanidæ.

THE perfection of preservation of the amber insects has made them a most attractive field of study. Most fossil insects are so discouragingly imperfect, that a knowledge of the actual structural details of some prehistoric insects is a most welcome contribution to the phylogeny of the group. And when this is brought out by so able a specialist in the group as by Dr. G. Ulmer in his "*Amber Trichoptera*"¹ we can place confidence in the interpretations. Probably the most important point is that the Limnephilidæ, now a dominant family in northern Europe, is lacking in amber, although all other families are represented, and the Sericostomatidæ by many remarkable genera. The presence of a few genera such as *Ganonema*, *Marilia* and *Triplectides*, now occurring in tropical regions, give one the impression (probably erroneous) of a warmer climate. Besides describing in detail the genera (56) and species (152) known from amber Dr. Ulmer presents many

¹"Die Trichopteren des Baltischen Bernsteins," *Schriften Physik.-Ökonom. Gesellsch. Königsberg; Beiträge zur Naturkunde Preussens*, Heft 10; 380 pages, 480 figs., 1912.

⁶*Ann. d. Phys.*, 40: 499, March, 1913.

⁷Dufour, *Annal. chim. phys.* (8), 9: 413, 1906.

new ideas in their classification and their bearing on the system of recent caddice-flies. It is thus a work of great use to all who study these insects.

M. E. GUYENOT is the author of a morphological study on the papillæ of the proboscis of Lepidoptera.² These occur on all Lepidoptera, but are variable in number and slightly in structure. The ordinary form is a sub-cylindric or fusiform process with the tip margined by a ring or a row of spinules. From the middle of the tip arises a short cylindric process or a spine. This process contains a nerve extending back through the main part of the papilla. Those on different parts of the proboscis vary in length and in development of spinules. Sometimes the papillæ are ribbed on the outside or with whorls of spinules. The author reaches no conclusion as to their function, but criticizes the tactile theory of Breitenbach.

THE increasing interest in medical entomology results in new treatises thereon; one of the most recent is by Dr. E. A. Goeldi.³ It is a very good and well-illustrated compilation on the subject. There are three principal chapters: I., Stinging, Biting and Urticating Insects; II., Parasitic Insects; III., Insects as Disease-carriers. Mites and other arachnids are included, and also the life cycle of the various Hæmatozoa.

THE stable fly, because of its biting habits and abundance, has been suspected of transmitting several diseases. In the Philippines it has been accused of carrying surra. Recently Dr. M. B. Mitzmain has investigated the matter.⁴ He conducted a long series of experiments, and only when the fly had bitten several hundred times was there a case of

²"Les papilles de la trompe des Lépidoptères," *Bull. Sci. France Belg.*, XLVI., pp. 279-343, 3 pls. (1913); many text figures.

³"Die sanitär-pathologische Bedeutung der Insekten und verwandten Gliedertiere, namentlich als Krankheits-Erreger und Krankheits-Überträger," 155 pages, 171 figs., 1913, Berlin, Friedländer u. Sohn.

⁴"Rôle of *Stomoxys calcitrans* in the transmission of *Trypanosoma evansi*," *Philipp. Journ. Sci.* (B), Vol. VII., pp. 475-518, 1913, 5 pls.

transmission. The trypanosome does not pass through any development in the fly, and so rarely is the fly an accidental vector that it may be absolved from connection with the disease.

KEILIN has lately noted⁵ that among the higher Diptera those forms that have on the ventral wall of the pharynx longitudinal chitinous folds are saprophagous, while the parasitic (including plant-parasites) and predaceous forms do not have these folds. It is, therefore, possible by examination of structure to learn the habits of certain Diptera. Thus *Graphomyia*, supposedly coprophagous, is probably carnivorous, and feeds on the other larvæ present in its habitat. Later Keilin shows that the Trypetidæ living in fruits have these folds which would indicate that they live on tissue attacked by a microorganism, introduced perhaps with the egg.

THE first volume on the flies of India is by Mr. Brunnetti,⁶ who for some years has resided in that country. Forty-four pages are devoted to an introduction including directions for the preparation of specimens for the cabinet. Over 425 species are described, a very large number being new, or recently described by the author. The Tipulidæ (with Ptychopterinæ) occupy a large part of the work. The genera are mostly the same or similar to our own, and only a few are described as new. There is also a glossary of terms used in Dipterology.

MANY entomologists will be interested in the new color manual⁷ of Dr. R. Ridgway. On the fifty-three colored plates are 1,115 named colors, and in text an alphabetical list of colors. A shorter series, if made available to all entomologists, would do much to standardize descriptions. NATHAN BANKS

⁵"Structure du pharynx au fonction du régime chez les larves de Diptères cyclorhaphes," *C. R. Acad. Sci. Paris*, t. 155, pp. 1548-1551, 1912.

⁶"The Fauna of British India, including Ceylon and Burma. Diptera Nematocera (exclusive of Chironomidæ and Culicidæ)," 581 pages, 7 pls., 1912.

⁷"Color Standards and Color Nomenclature," Washington, 1912, 43 pages, 53 col. plates.